# MONORAIL SYSTEMS ANALYSIS

## A SUPPLEMENT TO THE INTERIM REPORT

## ON

## EVALUATION OF TRANSIT CONCEPTS & VEHICLES

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# MONORAIL SYSTEMS

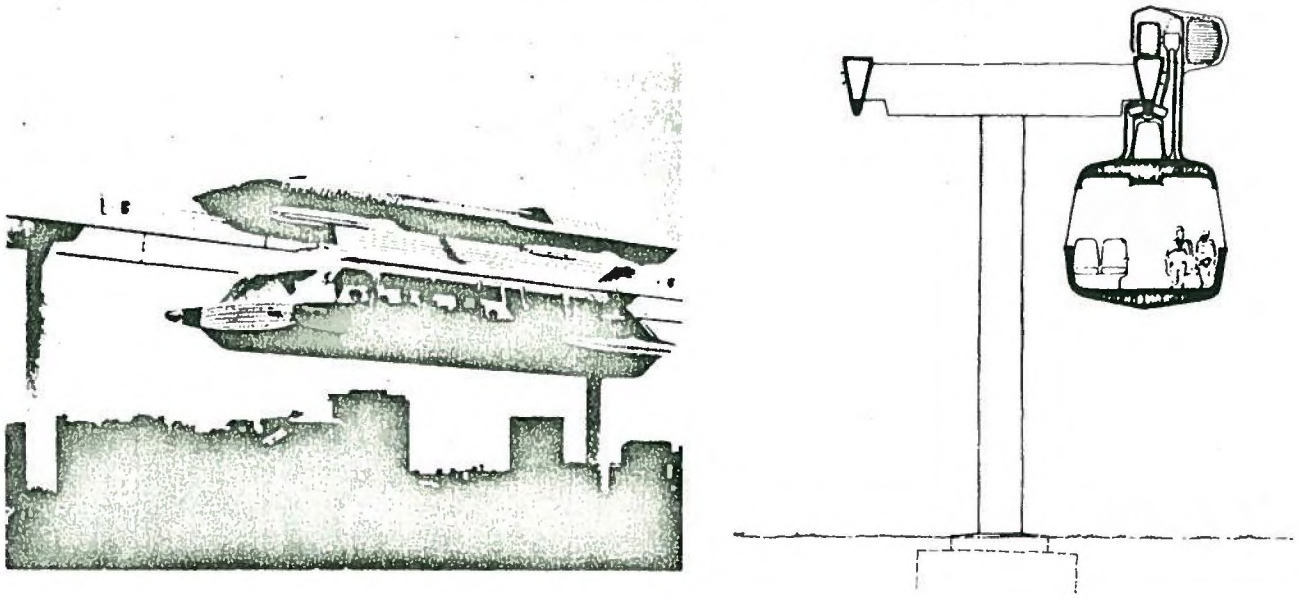
The type of transit vehicle systems generally referred to as "monorail" is a generic term applied to an extremely narrow gage vehicle system utilizing a single track and beam way structure for supporting the vehicle. The conventional transit vehicle, generally referred to as "dual-rail", requires two separate running tracks such as double steel rails for steel wheel vehicles or a double concrete running surface for rubber tire vehicles. Hence, a monorail system is characterized by the use of a single track on a support beam which the vehicle is suspended from or which supports the vehicle from the bottom.

There are two basic types of monorail systems--the overhead or suspended type and the bottom supported type. (See Figure 1) The suspended type is exemplified by the Goodell System, which utilizes the asymmetrical suspension concept and the SAFEGE System, which utilizes a split rail suspension concept. The supported monorail type is exemplified by the Alweg System.

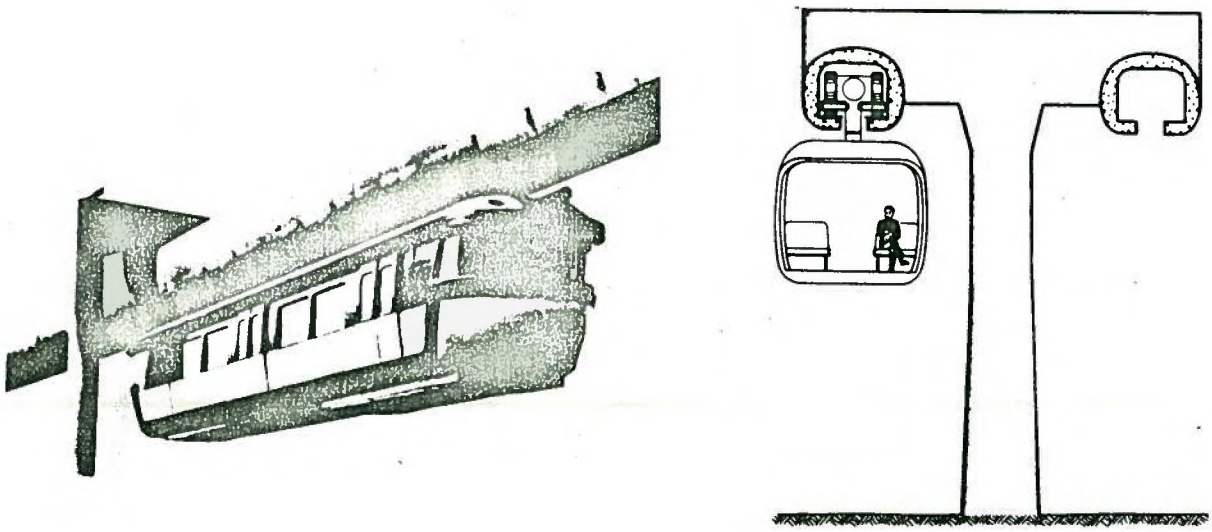
## The Goodell System

This system is asymmetrically suspended with the main support and traction wheels running on top of the "monobeam" with the use of secondary side wheels located at the bottom of the mono-beam for stability. The Goodell System has had limited development with a demonstration single-

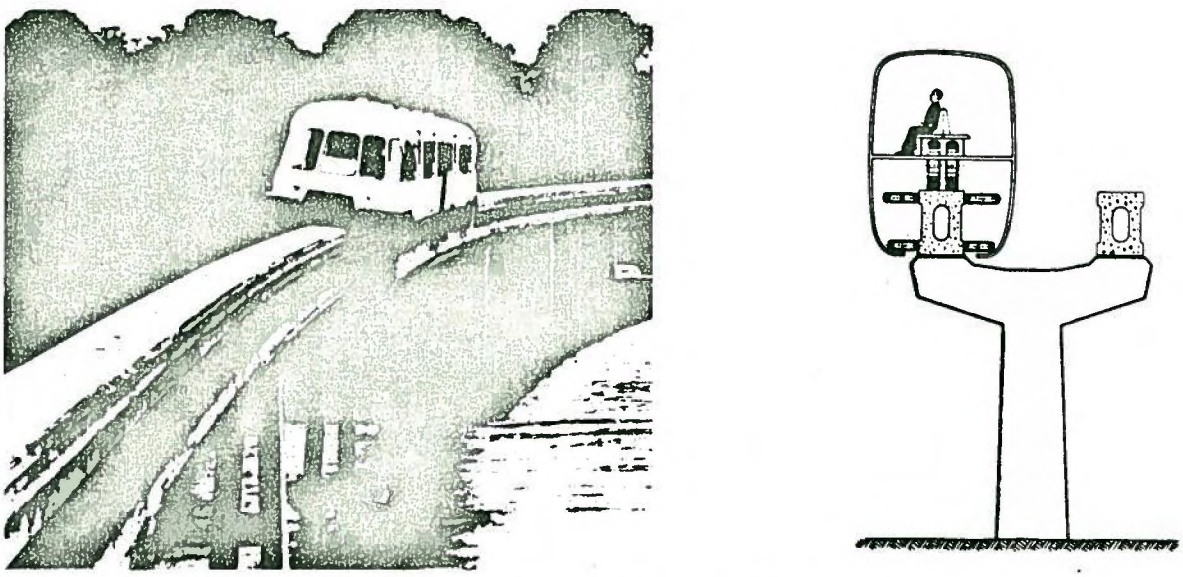
FIGURE 1



Goodell Mono-Rail



SAFEGE Monorail



Alweg Monorail

track facility built in Dallas, Texas. This installation was operated for only a short time and it did not have a switch. There is no indication of any serious and continuing development work being accomplished on this system at this time.

The SAFEGE System

This suspended split-rail monorail system has been developed as an outgrowth of the pneumatic-tire Paris Metro System. The basic concept of the system requires the supporting beam structure to be relatively large to accommodate the wheels and propulsion equipment. The system is characterized by having the supporting beam split or slotted at the bottom to accommodate the suspension element attached to the vehicle. A test installation exists in Orleans, France, but the system also does not appear to be receiving any serious development work.

The Alweg System

The supported monorail has secured extensive publicity and is represented by installations at Disneyland and the Seattle World's Fair. Also, the same system is in revenue service in Tokyo, Japan for airport access. All of these systems use the basic type of equipment developed by the Alweg Corporation.

The monorail vehicle supported on narrow gage wheels for operating

on a single track or running surface is contrasted with the substantially wider gage of conventional dual-rail systems. Since vehicle stability is a function of track gage, the monorail system must rely on secondary means of stabilizers such as additional side wheels or other stabilizing methods. The gage of the support wheels and the method of achieving vehicle stability is the basic difference between monorail and conventional systems.

In addition to the above mentioned difference between monorail and dual-rail systems, an equally pronounced difference exists within the monorail system itself, i.e. the suspended and the bottom-supported types. The suspended type features a high aerial structure to support the vehicles. Consequently, it has the inherent disadvantage of requiring aerial structures even if the system can be installed at-grade. This inflexibility of above-ground guideway construction and the added cost to build larger size tunnels for underground construction for the suspended monorail type have generally made the bottom-supported monorail type more attractive from the economic standpoint.

As was stated previously, there are two operating systems of the Alweg bottom-supported type in Disneyland and Tokyo. (The Seattle system has been removed.) However, it is interesting to note that no major city or region has adopted any type of monorail system for implementation as its

region-wide urban rapid transit system. Both the Disneyland and Tokyo monorail systems are special purpose facilities used for amusement ride and airport access respectively. These systems do not require fast and reliable guideway switching in that they are either a closed loop system or a point-to-point system. Additionally, these monorail systems are not operated at speeds of 60 mph or more as required for an urban rapid transit system and thus the riding quality as dictated by the stability of vehicles at high speeds has not been fully tested.

A comparison of key features of the monorail systems and the conventional rubber-tired system is presented in the attached comparison matrix chart. It can be readily seen from the chart that the bottom-supported monorail type is superior to the suspended type. It further shows that the conventional system is superior to the bottom-supported monorail system. This relatively simplified comparison matrix summarizes numerous studies conducted which concluded that the monorail systems, although new and exciting, does not offer any advantage in either performance or cost when compared to the modern conventional system.

COMPARISON MATRIX
OF
VEHICLE SYSTEMS

| | Monorail | | Conventional |
|---|---|---|---|
| | Suspended | Bottom-Supported | Rubber-Tired |
| Gradient Capability | Good | Good | Good |
| Safety from Derailment | Positive | Positive | Positive |
| Riding Quality | Fair in high winds | Fair at high speeds | Good |
| Emergency Evacuation of Passenger | Difficult | Easy | Easy |
| Visual Impact - Aerial Structure | High | Moderate | Low |
| Switching | Difficult | Moderate | Simple |
| Vehicle Design and Construction | Complex | Complex | Simple |
| Maintainability | Difficult | Moderate | Easy |
| Way Structure Cost | High | Moderate | Low |